

Does Functional Bracing of the Unstable Shoulder Improve Return to Play in Scholastic Athletes? Returning the Unstable Shoulder to Play

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Background: Functional bracing is often used as an adjunct to nonoperative treatment of anterior shoulder instability, but no study has evaluated the effectiveness of in-season bracing. The purpose of this study was to examine successful return to play in a nonoperative cohort of adolescent athletes with in-season shoulder instability and compare those athletes treated with bracing to those who were not.

Hypothesis: The use of functional bracing will improve success rates in a cohort of athletes treated nonoperatively for in-season shoulder instability.

Study Design: Cohort study.

Level of Evidence: Level 3.

Methods: A total of 97 athletes with anterior shoulder instability were followed for a minimum of 1 year. The mean age was 15.8 ± 1.4 years (range, 12.0-18.0 years). All athletes were treated with initial nonoperative management. Twenty athletes (21%) were also treated with bracing while 77 (79%) were not. The athlete completing the current season and 1 subsequent season without surgery or time lost from shoulder injury was defined as a successful outcome.

Results: There was no statistical difference in nonoperative success rates between the braced and nonbraced athletes ($P = 0.33$). Braced athletes ($n = 20$) returned to play 80% of the time, while nonbraced athletes ($n = 77$) returned at a rate of 88%. Of the braced athletes, 85% were football players ($n = 17$). A football-only comparison demonstrated no difference between braced failures (26%) and nonbraced failures (16%) ($P = 0.47$).

Conclusion: This is the first study to evaluate the utility of functional bracing in returning an athlete to sport and completing a full subsequent season without surgery or time loss due to injury of the shoulder. In adolescent athletes with shoulder instability treated nonoperatively, functional bracing did not result in increased success rates when compared with no bracing.

Clinical Relevance: The data from this study indicate that functional bracing may not improve success rates for athletes with shoulder instability.

Keywords: shoulder instability; nonoperative treatment; functional bracing; return to sport; recurrence

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Anterior shoulder instability is a common condition reported in adolescent and high school athletes.⁹ However, treatment strategies for anterior shoulder instability remain controversial.^{4,6} Some physicians support initial operative treatment while others recommend nonoperative management.^{3,10,15} The goal of either method is to provide the athlete with a stable, pain-free, and functional shoulder. Furthermore, successful treatment should allow the athlete to return to his or her prior level of participation without recurrence of instability or shoulder symptoms.

The recurrence rate of shoulder instability with nonoperative treatment in adolescent athletes after anterior shoulder dislocation has been reported to be high, ranging from 72% to 87%.^{7,12} Currently, there exist various functional braces that are marketed for shoulder instability.¹¹ The functional braces attempt to restrict shoulder motion from achieving combined abduction and external rotation, thus decreasing apprehension and possibly allowing the athlete to return to play.¹¹ Athletes have reported an improved sense of stability with functional bracing.¹ However, to date there has been no study that evaluates the role of functional bracing in the setting of nonoperative treatment for shoulder instability to determine whether the braces are effective in returning athletes to play. Furthermore, most studies that report on shoulder instability define treatment success as no recurrent instability event. This can be misleading, however, as some athletes with recurrence can return to successful play and report excellent outcomes, while others without recurrence may report poorer outcomes.¹³

The purpose of this study was to examine successful return to sport in a nonoperative cohort with in-season shoulder instability and compare these athletes treated with braces to those who were not. We hypothesized that the use of functional bracing would improve success rates in a cohort of athletes treated nonoperatively for in-season shoulder instability.

METHODS

This study was conducted over a 4-year period with adolescent athletes participating in 20 high schools in South Carolina. Athletes were included in the study if they competed on their high school sports team and suffered a traumatic time-loss anterior shoulder instability episode related to participation in a high school-sponsored athletic activity (either game or practice). Athletes were excluded if they presented with posterior/multidirectional instability, lacked an additional season of eligibility in the sport of injury, or if they refused care. Institutional review board approval was obtained prior to data collection.

A total of 97 adolescent high school athletes, who were treated conservatively and were eligible to return to sport the subsequent year, were included in this study. All injured athletes were diagnosed with either a first-time dislocation or subluxation by a board-certified sports medicine physician. Subluxation was defined as a shoulder that partially or incompletely dislocated but did not require a formal reduction. No athlete had sustained a documented prior dislocation or

subluxation event. The physician determined the athlete's diagnosis and treatment strategy with regard to functional bracing. All athletes who were braced used a Sully Shoulder Stabilizer (DJO Global). Compliance with bracing was confirmed by the school's athletic trainer who ensured proper fit as well as consistent wear for patients who were prescribed the brace by their treating physician. Athletes completing care and returning to adolescent sport were monitored by the scholastic athletic trainer for participation and development of subsequent injury for a minimum of 1 year. A successful outcome was defined as being able to return and complete the index and subsequent seasons in the sport of injury without surgery and without time loss due to shoulder symptoms. Athletes were not able to return to full competition until cleared by both the treating physician and school athletic trainer.

Statistical Analysis

Means and standard deviations were calculated for all demographic and descriptive variables to describe the population of interest. Chi-square and relative risk analyses were performed to compare the success of conservative treatment with and without use of a functional brace for the total cohort and within football athletes only. A power analysis was done a priori and determined that 44 subjects were required for the study to show statistical significance. For all statistical analyses, an alpha level of $P < 0.05$ was used. All data were analyzed using SPSS Version 24 (IBM Corp).

RESULTS

A total of 97 conservatively treated athletes were included in the study. The mean age of all the athletes was 15.8 ± 1.4 years (range, 12.0-18.0 years), the mean height was 176.4 ± 10.1 cm, and the mean weight was 82.5 ± 21.7 kg. Twenty-one percent ($n = 20$) of athletes with anterior shoulder instability who were treated conservatively were prescribed a functional sport brace. The mean age of the braced group was 16.4 years compared with 15.6 years of the nonbraced group. The mean height was 181.6 cm in the braced group compared with 174.2 cm in the nonbraced group. The mean weight was 93.4 kg in the braced group compared with 77.8 kg in the nonbraced group. The patients in the braced group were, on average, 6 months older ($P = 0.04$), 7.4 cm taller ($P = 0.006$), and 15.6 kg heavier ($P = 0.006$) than nonbraced athletes (Table 1), but sport and competition level were similar. There were no minimum time limits to return to sport, and there was no difference between braced and nonbraced athletes in terms of time between initial dislocation and return to play.

In the overall cohort, 84 (87%) athletes returned to play. Athletes treated with functional bracing successfully returned to sport at 80% frequency. Athletes in the nonbraced group returned at 88% frequency ($P = 0.33$) (Table 2). This difference in successful return to sport was not statistically significant ($P = 0.33$).

Of the athletes within this cohort, 57% participated in football but 85% of the braced athletes participated in football. Most braced athletes played football ($n = 17$), and a football-only

Table 1. Demographics comparing braced versus nonbraced athletes

	Nonbraced	Braced	P
Age, y, mean \pm SD	15.6 \pm 1.5	16.4 \pm 1.2	0.04
Height, cm, mean \pm SD	174.2 \pm 11.0	181.6 \pm 4.8	0.006
Weight, kg, mean \pm SD	77.8 \pm 21.5	93.4 \pm 18.5	0.006
Patients who dislocated, n	12	37	
Patients who dislocated, no RTS, n	5	6	
Patients who subluxated, n	8	40	
Patients who subluxated, no RTS, n	1	3	

RTS, return to sport.

Table 2. Cohort ability to return to sport (RTS) based on treatment strategy^a

	No RTS (n = 13), n (%)	RTS (n = 84), n (%)	F
No functional brace	9 (12)	68 (88)	0.19
Functional brace	4 (20)	16 (80)	

^aP = 0.33.

comparison between braced and nonbraced athletes demonstrated no difference between braced failures (26%) and nonbraced failures (16%) ($P = 0.47$) (Table 3).

When comparing younger athletes (<15 years of age; n = 19) with older athletes (>16 years of age; n = 34), there was a trend toward older athletes being braced more frequently ($P = 0.08$). When comparing those who successfully returned to sport and those who did not, there was no difference in age (15.7 \pm 1.5 vs 16.4 \pm 1.1 years of age; $P = 0.09$), height (175.4 \pm 9.8 vs 181.0 \pm 10.8 cm; $P = 0.08$), or weight (81.7 \pm 22.6 vs 85.7 \pm 17.6 kg; $P = 0.58$) between younger and older athletes in either group. There was no statistical difference in successful return to sport between age groups ($P = 0.22$). Similarly, when evaluating failures between the groups, there were no statistical differences found ($P = 0.29$).

In addition, we performed a subgroup analysis for those who dislocated versus subluxated. Among those who dislocated (n = 49), 12 were braced while 37 were not. Among those who subluxated (n = 48), 8 were braced while 40 were not. There was no difference in the frequency of bracing between these groups ($P = 0.33$). When comparing failures among the dislocation group (6 nonbraced, 5 braced) with those who failed among the subluxation group (3 nonbraced, 1 braced), there were no significant differences noted ($P = 0.60$).

Table 3. Football players' ability to return to sport (RTS) based on treatment strategy^a

	No RTS (n = 10), n (%)	RTS (n = 35), n (%)
No functional brace	4 (16)	21 (84)
Functional brace	6 (26)	14 (74)

^aP = 0.47.

DISCUSSION

The treatment protocol for patients who are treated conservatively after anterior shoulder instability remains controversial. Numerous functional braces are available on the market,¹¹ but no study to date has directly evaluated the role of functional bracing with regard to return to sport. We found that athletes treated conservatively who used functional bracing had similar rates of return to sport with athletes who did not wear a brace. A successful return to sport was defined as being able to return and complete the index and subsequent seasons in the sport of injury without surgery and without time loss due to shoulder symptoms.

In a recent survey of members of the American Shoulder and Elbow Surgeons, most respondents (87.2%) stated that they would allow an athlete with a first-time traumatic anterior shoulder dislocation to return to play in the same season but would recommend surgery at the conclusion of the season.⁴ Buss et al¹ reported that 26 of 30 (87%) athletes who experienced anterior shoulder instability during the season were able to return to their sport. Nineteen athletes wore a functional brace when returning.¹ Sixteen athletes underwent surgical stabilization once the season was complete.¹ However, it is unclear how many of these surgically repaired athletes may have been able to complete a subsequent season without surgery or time loss due to the shoulder.¹ A similar

strategy was utilized in a multicenter study of collegiate athletes published by Dickens et al.² In their study, 33 of 45 (75%) athletes were able to return to sport after anterior shoulder instability for either all or part of the season. Twenty-one (64%) athletes experienced recurrent instability.² Twenty of the 33 athletes that returned to competition used a brace. Dickens et al² found no association between brace use and recurrent instability.

Most studies that report on shoulder instability define treatment success in terms of whether the athlete experienced a recurrent instability event. This can be misleading, however, as some athletes with recurrence can return to successful play and report excellent outcomes, while others without recurrence may report poorer outcomes.¹³ We therefore chose to define success with a more functional “end result” outcome. In this study, success was defined as returning to the athlete’s original sport and completing the index season as well as an entire subsequent season without surgery or any time loss from injury to the shoulder. This approach helps address the question of whether to routinely perform arthroscopic stabilization surgery at the completion of the season, as well as whether bracing is an effective adjunct to sufficient rehabilitation in these athletes. In our cohort, 87% of conservatively treated athletes met this definition of success. This is in contrast to previous studies that reported nonoperative success rates of 8% to 25%.^{5,8,14} Differences between our data and those of previous studies may be due to different definitions of success.

Limitations

This study has several limitations. First, the sample size was small and no sample size estimate was obtained. This may have been an influence in our inability to detect a difference between groups. Further studies with larger cohorts are needed. Second, it is difficult to measure compliance with functional brace wear, although athletic trainers were present to supervise compliance of brace wear during practices and games, and it is standard policy in our county system that a prescribed brace must be worn during competition as a condition to return to play. Third, there was a lack of randomization between the braced and nonbraced groups, which may have presented a selection bias in that physicians may place braces on higher risk athletes. The 2 groups were different regarding size and age, with older, larger individuals more likely to be braced. Braced athletes were, on average, 6 months older, 7.4 cm taller, and 15.6 kg heavier than nonbraced athletes. Thus, we wondered whether size or age was a confounder affecting our results. A subanalysis of age, height, and weight, however, demonstrated no difference in any of these factors on success versus failure overall. Finally, there was no measure of humeral or glenoid bone loss and how these variables may have affected the success of bracing with regard to athletes returning to sport. Without such data it is difficult to determine whether the amount of bone loss played a factor in the decision to brace or not, thus changing the course of treatment.

This is the first study to evaluate successful return to sport using functional bracing in a nonoperative cohort of adolescent athletes with in-season traumatic anterior shoulder

instability. Future prospective, randomized studies are needed to fully understand the role of functional bracing in the nonoperative treatment of athletes with shoulder instability. Perhaps most surprising to us was that nonoperative management was more effective in both the braced and the nonbraced groups compared with previous literature.^{7,12} This difference may be explained by our criteria for success in this study, as defined by successful return to sport versus recurrence of shoulder instability.

CONCLUSION

This is the first study to evaluate the utility of functional bracing in returning an athlete to sport and follow-up of a full subsequent season without surgery or time loss due to injury to the shoulder. In athletes with shoulder instability treated nonoperatively, functional bracing did not result in increased success rates when compared with no bracing.

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